

**How the concept of evanescent point sources contributes to the understanding of microsphere-assisted microscopy**

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**Abstract for technical review (200-300 words; text only)**

Microsphere-assisted microscopy is an original method that allows label free full field super-resolution imaging to be achieved by simply adding a microsphere onto the sample under the microscope objective. Lateral resolutions reaching around a fifth of the wavelength in air and a seventh of the wavelength under immersion have been experimentally demonstrated. However, the physical explanation of sub-diffraction-limit resolution is not well understood. While a relationship to the photonic jet was initially proposed, the role of evanescent waves, the generation of whispering gallery modes and low coherence interference are now considered as the potential explanations. In this context, we introduce the concept of the evanescent point source and explain its role in microsphere imaging. In a classical point source, typically a Rayleigh dipole, both evanescent and propagative waves are intrinsically linked. On the contrary, the proposed evanescent point source here is a local maximum fully composed of evanescent waves. We show how this allows the imaging process to be more clearly understood. The evanescent waves appear to be coupled to whispering gallery modes of the microsphere and then converted to propagative waves collected by the microscope objective. The virtual image of two close point sources is computed, showing that the high spatial frequencies of these waves are not sufficient to justify the resolution improvement through the microspheres. Due to the small differences in optical paths involved, the low coherence of the source cannot thus be neglected and plays a key role.

**Summary of abstract for display in the program (50-150 words; text only)**

Microsphere-assisted microscopy is an imaging method that allows label free full field super-resolution to be achieved by adding a microsphere onto the sample under the microscope objective. Resolution improvement (a fifth of the wavelength in air and a seventh of the wavelength in immersion) has been experimentally demonstrated. However, the physical explanation of this resolution is not clear. We thus introduce the concept of the evanescent point source and its role in microsphere imaging. In a classical point source, typically a Rayleigh dipole, evanescent and propagative waves are intrinsically linked. On the contrary, the proposed evanescent point source is a local maximum fully composed of evanescent waves. We show how this allows the microsphere imaging process to be more clearly understood by also considering the coherence of the light involved.

**Keywords used in search for your paper (optional):** microsphere-assisted microscopy, super-resolution